

## SOME 'SOOTY MOULDS' COLLECTED IN QUEENSLAND

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## Abstract

*Setella halophila*, a new species, is described; this constitutes the first record of the genus in Australia. *Chaetothyrium Citri* (Arn.) Fisher is recorded for the first time in Queensland. Both fungi belong to the Chaetothyriaceae and occur on *Aegiceras corniculatum* Blanco, a mangrove species, which excretes large quantities of salt.

A new variety, *Asterina systema-solare* Mass. var. *minor*, is described and compared with Rodway's type of *A. systema-solare* Mass., which is also re-described.

Bailey first collected *Meliola polytricha* K. & C. on *Callistemon*. After comparison of Bailey's specimen and others collected by me, with type-material of the species, the Queensland specimens are referred to a new variety, *M. polytricha* K. & C. var. *queenslandica*.

The 'sooty mould' fungi are plentiful in the districts surrounding Brisbane, and some collections have been made, which are worthy of record.

The species considered here represent three of the families classified in an earlier paper (Fisher 1939).

## I. CHAETOTHYRIACEAE Th. emend. E. Fisher

*Setella halophila* sp. nov.

Hyphis brunneis septatis 3·5-7  $\mu$  diam., mycelium atrum membranaceum formantes. Ascocarpis globulis 60-100  $\mu$  diam., saepe ferentibus hyphales appendices setiformes 17·5-37·5  $\mu$  longas, apapophysatis; ascis 30  $\mu$  x 10  $\mu$ , octosporis, evanescentibus. Ascosporis, brunneis, ellipticis, 3-septatis, 10-12·5  $\mu$  longis, plerumque 11·25  $\mu$ , latis 3·75  $\mu$ , setis absentibus, ore pycnidii aliquid fimbriato. Pycnosporis hyalinis, ellipticis, non septatis, plerumque 5  $\mu$  longis, 2·5  $\mu$  latis. Conidiis sparse formatis, brunneis, fusiformibus, phragmoseptatis, 65  $\mu$  longis x 10  $\mu$  parte latissima. *Hab.*: In salso sudore in summis foliis *Aegiceras corniculati*. Southport, Queensland, Australia, August 1947.

*Leg.* R. F. Langdon. (Typus in Kew et in Herb. auct.)

*Setella halophila* n.sp. is described from a sooty mould occurring on the leaves of *Aegiceras corniculatum* Blanco, which was collected at Southport, on the Queensland coast, 47 miles south-east of Brisbane. *Aegiceras corniculatum* is a mangrove species, which excretes a large amount of salt through the leaves, thus providing a saline substratum for the mould. The epithet 'halophila' has therefore been chosen to denote the high saline tolerance of this fungus.

As is characteristic of the family *Chaetothyriaceae*, *S. halophila* forms a thin, membranous, sooty film, which may be readily separated from the surface of the host leaf. The mycelium consists of hyphae of two types. The more superficial hyphae are 5-7  $\mu$  diam., dark brown, septated and constricted at the septa, to form approximately isodiametric cells (Fig. 1, d). The hyphae which lie nearer to the surface of the leaf are narrower, approximately 3·5  $\mu$  diam., light brown, septated, but not constricted at the septa (Fig. 1, e).

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There is an abundant development of ascocarps. These are globular in shape, ranging from  $60\ \mu$  to  $100\ \mu$  diam. The wall of the ascocarp is dark and dense in structure; its surface may be smooth, but frequently bears 2-7 bristle-like, hyphal appendages,  $17.5$ - $37.5\ \mu$  in length (Fig. 1, f). Paraphyses are absent; the asci are 8-spored and measure  $30\ \mu \times 10\ \mu$ . The thin walls of the asci break down early, so that the mature ascospores are rarely found enclosed by the ascus; they are usually set free inside the ascocarp. The ascospores, which measure  $10$ - $12.5\ \mu$  (average  $11.25\ \mu$ ) in length, and  $3.75\ \mu$  in width, are brown, elliptical, and divided into 4 cells by 3 transverse septa.

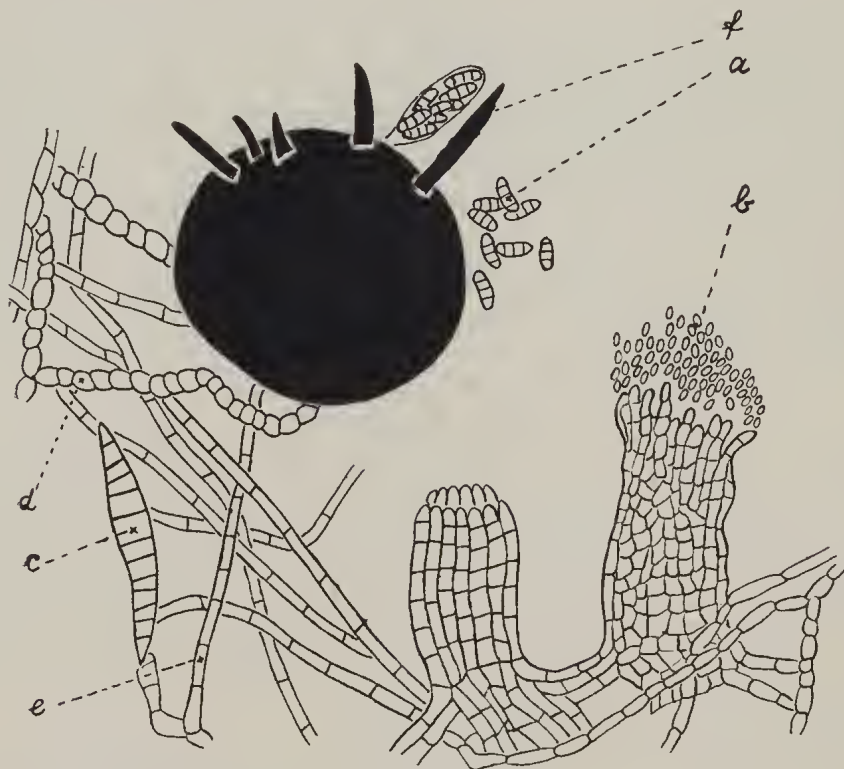


FIG. 1.—*Setella halophila* n.sp. from leaf of *Aegiceras corniculatum*, treated with lacto-phenol. a, ascospore; b, pycnospore; c, conidium; d and e, hyphae; f, bristle-like appendage to ascocarp. Camera-lucida drawing  $\times 375$ .

Cylindrical pycnidia, measuring approximately  $87.5\ \mu$  in length and  $30\ \mu$  in width, are also formed in large numbers. The pycnidia are lighter brown in colour, and the hyphal structure of the wall is more readily discernible than that of the ascocarps. There are no bristle-like appendages. Pycnospores emerge in large masses (Fig. 1, b) through the mouth of the pycnidium, which is slightly fimbriate. The pycnospores are colourless, elliptical, non-septate, and measure  $5\ \mu \times 2.5\ \mu$ .

In addition to the formation of ascocarps and pycnidia, there is a sparse development of conidia. These are brown, spindle-shaped, phragmoseptate spores, measuring  $65\ \mu$  in length, and at the broadest part  $10\ \mu$  in width (Fig. 1, c).

This fungus has been referred to as a new species, because it differs in certain important respects from the only previously described species of the genus, *Setella*.

In *S. disseminata*, which was described by Sydow (1916) on species of bamboo, in the Philippines, the ascospores are much larger, measuring  $20-30 \mu \times 9-10 \mu$ . Also the pycnidia are different; in *S. disseminata* they are described (Sydow 1916) as globular and externally resembling ascocarps, but without bristles. Furthermore, in Sydow's species, mycelial development is sparse, in contrast to the abundant development of hyphae found in the species here described.

### *Chaetothyrium Citri* (Arn.) Fisher

A 'sooty mould' which is identical macroscopically with that produced by *S. halophila* has been collected on *Aegiceras corniculatum* growing near Redcliffe, on the coast, 24 miles north-east of Brisbane. On microscopical examination, however, *Chaetothyrium Citri* (Arn.) Fisher was found to be the fungus responsible for this mould.

*C. Citri* has been recorded (Fisher 1940) from both coastal and inland districts in Victoria, but this is the first record of the species in Queensland. This collection was made in October, 1948; then, ascocarps were abundant and pycnidia very sparsely developed.

Under Victorian conditions, a definite seasonal cycle in spore development was observed, with a maximum development of the ascigerous stage during summer months (Fisher 1940, p. 195).

It has not been possible to make detailed observations on the life-cycle of *C. Citri* in southern Queensland, but it would appear that, under warmer climatic conditions, the formation of ascocarps occurs earlier than in Victoria.

It should also be noted that the ascocarps are devoid of bristles, and the hyaline, 3-6 septate ascospores, which measure  $17.5-22.5 \mu \times 3.7-5 \mu$ , are more uniform in size than in Victorian specimens.

## II. MICROTHYRIACEAE Sacc.

### *Asterina systema-solare* Mass. var. *minor* E. Fisher

*Mycelio stellata* saepe colonias sparsas formante 1-4 mm. diam. Hyphis brunneis septatis  $2.5-3.75 \mu$  diam. Hyphopodiis integris,  $3.75-5 \mu \times 5-7.5 \mu$ , vel convolutis,  $7.5-10 \mu \times 10-15 \mu$ . Ascocarpi radiantibus, ostiolatis, clypeatis  $75-200 \mu$  diam. Ascis octosporis, clavatis,  $60-65 \mu \times 12.5-15 \mu$ . Ascosporis brunneis, ellipticis, ovoidis, uniseptatis,  $12.5-15 \mu \times 5-6 \mu$ . *Hab.*: In summis foliis *Banksiae roboris*, Sunnybank, prope Brisbane, Queensland, Australia, September 1947; et *B. roboris* var. *minoris*, Beerwah, Queensland, Australia, October 1947.

*Leg.* E. Fisher (Typus in Kew et in Herb. auct.)

*Asterina systema-solare* Mass. var. *minor* E. Fisher forms a thin sooty film, of asterinoid type of growth, which occurs quite commonly on *Banksia robur* Cav. and on a variety with smaller leaves, *B. robur* Cav. var. *minor* Maid. and Camf. Collections have been made at Beerwah, approximately 50 miles north-east of Brisbane, also at Sunnybank, 10 miles south of Brisbane.

Before describing this new variety in detail, it is desirable that the species *Asterina systema-solare* Mass. should be reviewed.

Massee (1901) described the species *A. systema-solare* on the leaves of *Banksia marginata* Cav. collected in Tasmania by Rodway (1897). Ryan (1939) referred



this species to *Prillieuxina*, a genus which may be distinguished from *Asterina* by the absence of hyphopodia.

Through the courtesy of the Director, Royal Botanic Gardens, Kew, England, I have examined type-material of *A. systema-solare*, and hyphopodia are clearly present. (Plate IV, fig. 1.) Therefore, this species should not be included in the genus *Prillieuxina*.

Hyphopodia are not mentioned in Masee's original description of *A. systema-solare*, likewise there is no reference to the radial construction of the ascocarps, which is so characteristic of the Microthyriaceae. Furthermore, my examination of type-material has shown that the dimensions of the ascospores are larger than is indicated in Masee's original description.

In view of these ambiguities, and the discrepancy in spore measurements, *A. systema-solare* Mass. is now re-described, from Rodway's type, No. 540.

The mycelium forms black patches 0.5-1.5 mm. diam. on the upper surface of leaves of *Banksia marginata* Cav. Hyphae brown, septate, 2.5  $\mu$  diam., hyphopodia present, 5-10  $\mu$  x 7.5-22.5  $\mu$ . Ascocarps radially constructed, ostiolate, circular, shield-shaped, 150-260  $\mu$  diam. (Plate IV, fig. 2.) Asci 8-spored, thick-walled, clavate-ovoid, 55-67.5  $\mu$  in length x 17.5-22.5  $\mu$  in width. Ascospores brown, elliptical-ovoid, uni-septate, 15-17.5  $\mu$  x 6-7.5  $\mu$ .

Narrow, branched, colourless hyphae are intermingled with the asci, forming part of the hymenial layer. (Plate IV, fig. 3.) If these sterile hyphae are interpreted as paraphyses, and if the classification of Stevens and Ryan (1939) is followed, *A. systema-solare* should be transferred to the genus *Parasterina* Theiss. and Syd. This genus was created (Sydow 1917, p. 246) for the purpose of separating paraphysate species from other members of the genus, *Asterina* Lév.

Apparently realizing the difficulty of identifying paraphyses accurately, Theissen (1918, p. 4) later distinguished between true paraphyses, the ends of which are free, and 'paraphysoides', in which the ends of the hyphae are united to form a membranous layer covering the hymenium. Also, Ryan (1939, p. 78) has used the term 'pseudoparaphysate' to describe a species, referred to an aparaphysate genus.

It would appear, therefore, that the presence of paraphyses is not a reliable generic feature, and I will refer the species *A. systema-solare* to the genus *Asterina*.

The specimens collected by me have been referred to a new variety of *Asterina systema-solare* as the ascospores are smaller than in the type-material; also, the asci are narrower and more distinctly club-shaped. The hymenial layer contains fewer sterile hyphae than in Rodway's original material, but the specimen illustrated in Plate IV, fig. 5, has been focused to show one such colourless hypha.

The mycelium is sometimes well developed, forming an asterinoid type of growth over the entire upper surface of the host leaf, but it may form discrete isolated colonies approximately 1-4 mm. diam., similar to those described from Rodway's type-material.

Hyphae brown, septate, 2.5-3.75  $\mu$  diam. Hyphopodia may be entire, measuring 3.75-5  $\mu$  x 5-7.5  $\mu$ , or convoluted and measuring 7.5-10  $\mu$  x 10-15  $\mu$ . Ascocarps are radially constructed, ostiolate, circular shield-shaped, measuring 75-200  $\mu$  diam. (Plate IV, fig. 4.) Asci 8-spored, clavate, 60-65  $\mu$  x 12.5-15  $\mu$ . Ascospores brown, elliptical-ovoid, uni-septate, 12.5-15  $\mu$  x 5-6  $\mu$ . *Habitat*: On the upper surface of leaves of *Banksia robur* Cav., Sunnybank, near Brisbane, Queensland, Australia, September 1947; and *B. robur* Cav. var. *minor* Maid. and Camf., Beerwah, Queensland, Australia, October 1947.

*Synonymy*

Stevens and Ryan (1939) have included *Seynesia Banksiae* Henn. and *Didymosphaeria Banksiae* Cke. in the synonymy of *P. systema-solare* (Mass.) Ryan. It would appear that *Seynesia Banksiae* is correctly placed. Hennings (1903) described this species from the leaves of *Banksia* collected in southern Queensland; and although he does not indicate the species of host plant, Bailey (1909, p. 765) has recorded *S. Banksiae* or *Banksia latifolia* R.Br., a species which is synonymous with *B. robur* Cav.

*Didymosphaeria Banksiae*, on the other hand, should not be included in the synonymy of *P. systema-solare*. Cooke's description (1890) of *D. Banksiae* on leaves of *Banksia* collected in Victoria was prior to Masee's description of *A. systema-solare* (1901); and the examination of type-material has shown that the two species are distinct.

Miss E. M. Wakefield, who has examined the type-material of *D. Banksiae* on my behalf, comments that this species is 'erumpent with never a trace of superficial mycelium'. *A. systema-solare*, on the other hand, is characterized by a superficial mycelium bearing hyphopodia (Plate IV, fig. 1).

Furthermore, through the courtesy of the Director, Royal Botanic Gardens, Kew, I have been able to examine a specimen of *D. Banksiae* which is considered by Miss Wakefield to be identical with the type. In this specimen, which was collected by C. T. White at Cooloongatta, Queensland, not only is superficial mycelium completely lacking, but there is no evidence of radial construction of the ascocarps.

Therefore *D. Banksiae* Cke. is quite distinct from *A. systema-solare* Mass., and it should not be referred to the family *Microthyriaceae*.

## III. PERISPORIACEAE Fr.

***Meliola polytricha* K. and C. var. *queenslandica* E. Fisher**

Mycelio nigras colonias separatos formante, circiter 1-2 mm. diam. Hyphis brunneis, septatis, 7.5  $\mu$  diam. Hyphopodiis capitatis 10-15  $\mu$  x 17.5-25  $\mu$ . Setis aciculiformis, mycelii 320-400  $\mu$  longis x 7.5-8.5  $\mu$  latis ad basin. Ascocarpis globosis 150-250  $\mu$  diam. Ascis 2-sporis, solum sporis immaturis hyalinis in ascis visis. Maturis ascosporis brunneis, 4-septatis, cylindricis, utrinque obtusis, 55-65  $\mu$  x 17.5-22.5  $\mu$ . Conidiis brunneis 3-4 septatis, 30-40  $\mu$  x 7.5  $\mu$ , solum in specimine Bailey visis. *Hab.*: In summis foliis *Callistemon viminalis*, Gold Creek, prope Brisbane, Queensland, Australia, September 1947; *Callistemon*, Brisbane, Bailey's collection No. 633.

*Leg.* E. Fisher. (Typus in Kew et in Herb. auct.)

This fungus was found on *Callistemon viminalis* (Sol.) Cheel growing near Gold Creek, approximately 13 miles north-west of Brisbane.

An earlier collection on *Callistemon* in the Brisbane area was made by F. M. Bailey, and this was identified by Cooke as *Meliola polytricha* K. and C. Through the courtesy of the Director, Royal Botanic Gardens, Kew, I have been able to examine specimen No. 633 from Bailey's collection, and in the matter of ascospore measurements it agrees closely with the specimens collected by me. However, both of these collections differ from the type-material with which I was able to compare them, in that the ascospores are significantly larger.

*Meliola polytricha* K. and C. was described by Cooke (1880) from leaves of *Osyris compressa* and *Cunonia capensis*, collected in Natal, South Africa.

Cooke did not state the ascospore measurements, but Doidge (1915) has re-described the species and the measurements given by her,  $45\text{--}55\ \mu \times 16\text{--}18\ \mu$ , agree with my examination of types Nos. 1256 and 1262 from Kalchbrenner's herbarium.

The ascospores from Australian specimens are consistently larger; in Bailey's specimen No. 633, ascospores measured  $57\cdot5\text{--}60\ \mu \times 17\cdot5\text{--}22\cdot5\ \mu$  and those from the Gold Creek collection on *Callistemon viminalis* were  $55\text{--}65\ \mu \times 17\cdot5\text{--}22\cdot5\ \mu$ .

*Meliola polytricha* var. *abyssinca* was described by Hennings (1893). In this variety the range of ascospore measurements is almost wide enough to include the Australian representatives of *M. polytricha*. However, the spores seen in Bailey's collection, and in my own, do not approach the lower limits of spore-size attributed to Henning's specimens, and so a new variety is described on *Callistemon viminalis*.

*Meliola polytricha* K. and C. var. *queenslandica* E. Fisher

Mycelium forms black colonies approximately 1-2 mm. diam. on both upper and lower surfaces of leaves. Hyphae dark brown, septate,  $7\cdot5\ \mu$  diam. Hyphopodia capitate  $10\text{--}15\ \mu \times 17\cdot5\text{--}25\ \mu$ . Mycelial setae,  $320\text{--}400\ \mu$  in length  $\times 7\cdot5\text{--}8\cdot5\ \mu$  wide at the base, and tapering to an acute tip. Ascocarps globose,  $150\text{--}250\ \mu$  diam. Asci are 2-spored; the wall of the ascus breaks down early and only immature colourless spores have been found inside an ascus. Mature ascospores are brown, 4-septate, cylindrical, rounded at both ends,  $55\text{--}65\ \mu \times 17\cdot5\text{--}22\cdot5\ \mu$ . Conidia were not observed on specimens collected by me, but on Bailey's material conidia were found, light brown, 3-4 septate,  $30\text{--}40\ \mu \times 7\cdot5\ \mu$ .

*Habitat*: On leaves of *Callistemon viminalis* (Sol.) Cheel collected at Gold Creek, near Brisbane, Queensland, Australia, September 1947; *Callistemon*, Brisbane, Bailey's collection No. 633.

### Summary

One new species and two new varieties of 'sooty mould' fungi are described.

The new species, *S. halophila* constitutes the first record of the genus *Setella* in Australia; and the occurrence of *Chaetothyrium Citri* is recorded for the first time in Queensland. There is no previous record of any representative of the family Chaetothyriaceae being collected in Queensland; and it is interesting to note that *S. halophila* and *C. Citri* have both been found on the leaves of *Aegiceras corniculatum*, a mangrove species, which excretes large quantities of salt.

The two new varieties, *Asterina systema-solare* var. *minor*, and *Meliola polytricha* var. *queenslandica*, represent the families Microthyriaceae and Perisporiaceae respectively.

### Acknowledgments

I wish to thank Miss E. M. Wakefield, Herbarium, Kew, England, for supplying me with specimens and notes from publications unobtainable in Australia; also Mr. J. H. Willis, National Herbarium, Botanic Gardens, Melbourne, for the Latin diagnoses. The identification of the host plants was made by the staff of the National Herbarium, Botanic Gardens, Brisbane, and the photographs were taken by Mr. C. Illidge, Botany School, University of Queensland.

Portions of the type-specimen of *Setella halophila* n.sp., and of the new varieties herein described, have been sent to the Herbarium, Royal Botanic Gardens, Kew, England.

## References

- BAILEY, F. M., 1909. Comprehensive catalogue of Queensland Plants. Government Printer, Brisbane.
- COOKE, M. C., 1880. Natal Fungi. *Grev.*, 8: 72.
- , 1890. Australian Fungi. *Ibid.*, 19: 90.
- DOIDGE, E. M., 1915. South African Perisporiales. *Trans. Roy. Soc. Sth. Africa*, 5: 735.
- FISHER, E. E., 1939. A Study of Australian "Sooty Moulds". *Ann. Bot.*, n.s., 3: 399-426.
- , 1940. Notes on some Australian "Sooty Moulds". *Ibid.*, 4: 195-197.
- HENNINGS, P., 1893. Bull de l'Herb. Boissier. Tome 1, Genève, p. 117.
- , 1903. Fungi Australiensis. *Hedw.*, 42: 78.
- MASSEE, G., 1901. Fungi Exotici, III. *Kew Bull.*, p. 160.
- RODWAY, L., 1897. Tasmanian Fungi. *Proc. Roy. Soc. Tas. for 1897*, p. 141.
- STEVENS, F. L., and RYAN, M. H., 1939. The Microthyriaceae. Univ. Illinois Press, Urbana, Illinois.
- SYDOW, H. and P., 1916. Weitere Diagnosen neuer philippinischer Pilze. *Ann. Myc.*, 14: 359.
- , 1917. Beitrag zur Kenntnis der Pilzflora der Philippineninseln. *Ibid.*, 15: 165-268.
- THEISSEN, F., and SYDOW, H., 1918. Vorentwürfe zu den *Pseudophaeriales*. *Ibid.*, 16: 1-34.

## Explanation of Plate IV

Figs. 1-3. Rodway's type No. 540. *Asterina systema-solare* Mass.

Fig. 1.—Mycelium showing hyphopodia.  $\times 350$ .

Fig. 2.—Ascocarp showing radial structure.  $\times 208$ .

Fig. 3.—Contents of ascocarp showing sterile hyphae and asci containing ascospores.  $\times 350$ .

Figs. 4 and 5. *Asterina systema-solare* Mass. var. *minor* E. Fisher.

Fig. 4.—Ascocarp showing radial structure and mycelium with hyphopodia.  $\times 350$ .

Fig. 5.—Ascocarp ruptured to show contents. Note branched sterile hypha lying across ascus, in centre of photograph.  $\times 350$ .